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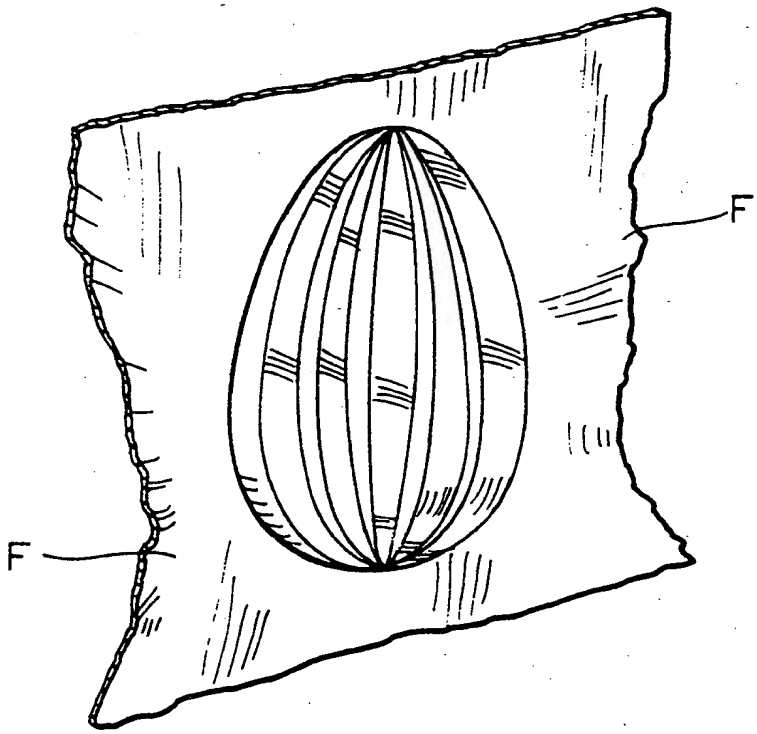
(54) Title: A PROCESS FOR FORMING WRAPPERS OF THIN SHEET MATERIALS AND A DEVICE FOR CARRYING OUT SAME

(57) Abstract

A sheet wrapping material (F), such as, for example, thin aluminium foil, is preformed to a generally dished shape complementary to that of the product to be covered. Before it is formed into the dished shape, the sheet material (F) undergoes a pleating process (1, 2) which prevents ripping or tearing during the subsequent formation of the dished shape.



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A process for forming wrappers of thin sheet materials and a device for carrying out same

The present invention relates in general to the formation of wrappers (or coverings) of thin sheet materials and has been developed with particular attention to its possible use for producing wrappers for confectionery products such as, for example, chocolate eggs.

In this field of application, reference to which should not, however, be interpreted in a limiting sense, there is generally a problem in fitting the shape of the wrapper (which typically is made of thin sheet material such as, for example, aluminium foil) to the shape of the product to be wrapped. The product may include one or more rounded portions or may be wholly constituted by such portions; for example, it may be a chocolate egg constituted by two complementary portions each of which has a rounded shape; the same can also be said of generally spherical products and the like.

Up to now, two different solutions have been used to form wrappers of thin sheet material for such products.

The first solution, the use of which predominates widely in industry, is that of taking the generally flat sheet material and wrapping it around the product to be wrapped by means of automatic or semi-automatic equipment which copies the sequence of steps which would be carried out by a human operator.

This solution is certainly satisfactory for many applications, particularly when the wrapping sheet is uniform in appearance (for example, a sheet of silvered or gilded aluminium) so that the random or

pseudo-random distribution of folds formed in the sheet when it is wrapped around the product has no particular relevance; the distribution of folds may thus actually help to make the appearance of the wrapped product more pleasing, at least in some cases. If pictures, drawings or wording are applied to the wrapper, however, the situation is more difficult; in this case, the formation of folds in the wrapping sheet may detract from a general appreciation of the graphic symbols and, at least in some cases, may make the wording applied to the wrapper practically illegible.

Another solution which is documented, for example, by Italian patent 651,202, German patent 598,113, and also German patent 1,784,647 provides for the sheet wrapper to be preformed before it is applied to the product to be wrapped so that it assumes beforehand a shape which exactly fits the product to be wrapped. The preforming of the sheet material can be controlled precisely so as to limit, if not completely eliminate, the formation of folds, thus preventing the problems cited above. This solution has found considerable success, particularly with plastics wrapping materials, for which the preliminary forming operation can be effected by heating the material so as to soften it and then forming it by various moulding techniques.

The application of this solution to metal wrapping sheets, typically aluminium foil, however, appears more difficult. In practice, it is found that the technique of preforming metal foil can be used successfully only with materials of a certain thickness (for example, a few tenths of a millimeter, as is the case with some aluminium foil wrappers used for some pharmaceutical products, such as suppositories, or for

making trays for holding products).

Without wishing to be bound to any particular theory in this connection, one has reason to believe that the chances of success with this technique are linked essentially to the use of materials of thicknesses such that the wrapper or covering can be preformed by a drawing process, that is, with a certain stretching of the material, without causing tears.

When the material of the wrapper is thin, however, (as in the case of aluminium foil of the order of 10-20 μ thick) it is practically impossible to preform the foil (for example, to give it a dished shape like the portions which constitute a chocolate egg) without it tearing or splitting.

According to a solution tested by the Applicant, the tearing of the wrapper or covering during the preforming can be prevented, to a certain extent, by subjecting the foil to an embossing process, which term, in the field of sheet materials, means the formation of a dense pattern of surface irregularities (for example, in the form of small cones, cylinders, or a generally "ravioli-like" structure) with dimensions generally smaller than 1 mm. The Applicant has found, however, that such a solution is unsatisfactory since it does not bring the tearing of the sheet material during preshaping below a statistically appreciable level.

The object of the present invention, therefore, is to provide a method of forming wrappers of thin sheet material, particularly metal foil, which does not give rise to the problems described above.

According to the present invention, this object is achieved by virtue of a method having the specific characteristics recited in Claim 1. Advantageous developments of the invention are recited in Claims 2 to 26.

Another subject of the invention is a device or tool for carrying out the method of the invention as claimed in Claim 27. Further advantageous developments of this device are recited in Claims 28 to 40.

Briefly, the present invention is based on the recognition of the fact that a wrapper of a thin material, particularly metal such as, for example, aluminium, can be formed into a generally dished shape, for example, in order to form part of a wrapper for covering one of the halves of a chocolate egg, without the risk of tearing, provided that, before the forming step, the sheet undergoes a pleating process which is preferably effected along meridians of the dished shape (in the manner which will be explained further below).

By way of premise, it should be noted that, the term "pleating" as used in the present description and the in the following claims, refers to the formation, in a sheet material, of a series of folds or pleats having dimensions generally larger than one millimetre, typically of the order of at least a few millimetres, for example, 5-8 millimetres or more.

The invention will now be described, purely by way of non-limiting example, with reference to the appended drawings, in which:

Figures 1 to 8 show schematically various steps of a

method according to the invention,

Figures 9 and 10 show in greater detail the results obtained by some of the steps of Figures 1 to 8,

Figure 11 shows in greater detail the structure of a device for use in the method according to the invention,

Figure 12 is a section taken on the line XII-XII of Figure 11, and

Figures 13 to 15 show the operation of the device of Figures 11 and 12, in greater detail.

The present invention will be described, by way of example, with reference to the formation of a thin aluminium wrapper (with a thickness of the order of 10-20 μ, typically 11.4 μ) for a product constituted by a chocolate egg U of substantially the same dimensions as a hen's egg.

In particular, Figures 1 to 4 show schematically the sequence of steps which lead to the formation of one of the two symmetrical halves of the wrapper, that is, of the dished portion (shown in detail in Figure 10) which is intended to cover one half of the egg U. Figures 5 to 8, however, show how two dished portions formed by the sequence of steps of Figures 1 to 4 can be arranged around a chocolate egg U so as to form a wrapper of thin sheet material.

As already indicated, the method of the invention may, however, be used for different applications, and hence for wrapping products other than confectionery or food

products in general or for wrapping products which are not egg-shaped or spherical, for example, for wrapping products such as roughly hemispherical pralines. In the latter case, the method of the invention could, to advantage, be used to form the dished portion for covering the hemispherical portion of the product. The dished portion formed according to the invention could be joined, for example, to a flat or cup-shaped sheet constituting the portion of the wrapper which is wrapped around the base of the product. The method of the invention may also, to advantage, be used to form only a particular dished portion of part of a larger wrapper.

Figure 1 shows how the sheet wrapping material F (for example, aluminium foil 11.4 μ thick) can be passed through a unit including a punch 1 and a die 2 having the specific characteristics recited below with reference to Figures 11 and 12, in order to form a generally pleated effect therein.

In the industrial method, the sheet wrapping material F advances towards the punch-die unit 1, 2 from an unwinding reel (not shown) and may be divided, beforehand or simultaneously, into small sheets for forming respective dished wrapping portions.

As will become clearer from the following, the die 2 (or the female portion of the pleating device) represents a general development in a plane of the overall shape of the product to be wrapped by the sheet F. For example, in the case of a spherical product, the die 2 will be generally circular, whereas in the case of an egg-shaped product (which is the specific case to which the present description relates) it will

be generally oval (and flat). In both cases, the die 2 has a series of grooves 3 of approximately triangular cross-section extending generally along meridians of its shape. For example, in the case of an oval die (see also Figure 11), the grooves 3 extend in a generally symmetrical arrangement from the base of the egg-shape towards its tip. As already stated, the grooves 3 - and hence the corresponding pleats formed in the sheet F - have dimensions of the order of at least a few millimetres.

Figure 2 shows schematically the situation in which the punch 1 and the die 2 have come into contact with each other, clamping the sheet F between them and thus forming the pleats therein.

As will become clearer from the following, during the pleating operation, the sheet F is not clamped completely rigidly but retains a certain ability to slide between the punch 1 and the die 2, giving rise to a general inward movement towards the centre of the pleating device 1, 2 as the pleating operation gradually proceeds. This movement towards the centre is facilitated, as will become clearer from the following, by the conformation of the punch 1 which, in the rest condition, has a generally three-dimensional shape with central portions which project further than its peripheral portions, and which - during its movement in order to mate with the die 2 - gradually changes to a generally flat configuration.

The Applicant has found that the ability to slide, which is also facilitated by the presence of a lubricant lacquer (for example, a polyethylene lacquer) on at least one or, even better, on both faces of the

sheet F, is extremely advantageous for preventing the risk of tearing.

The sheet F which is being pleated (shown in detail in Figure 9) is then passed (Figures 3 and 4) to a further forming device which is also constituted by a punch 4 and a die 5. These are intended to effect the actual forming of the already-pleated sheet F, giving it a shape precisely corresponding to that of the product (the egg U in the embodiment to which the present description relates) to be covered by the sheet.

In the specific embodiment, the punch 4 and the die 5 will therefore have positively and negatively dished (half) egg-shapes, respectively.

As a result of the mating of the punch 4 and the die 5 (see Figure 4), the sheet F assumes the dished, egg-shaped configuration to be imparted thereto, as shown in Figure 10.

As a result of the previous pleating process (Figures 1 and 2), the dishing can be achieved without risk of tearing, even with very thin sheets F, for example, 11.4 μ thick aluminium foil.

Without wishing to be bound to any particular theory in this connection, one has reason to believe that the main effect of the pleating operation is to prevent any stretching of the material (which does, however, occur in solutions in which the forming is carried out directly on a flat sheet) during the subsequent forming operation, even as a result of its slight movement towards the centre, mentioned above.

In this case, it has also been found that the presence of a lacquer which has a lubricating effect on one or, even better, on both faces of the sheet F is beneficial in further reducing any risk of tearing.

Moreover, it has been found advantageous for both the punch 4 and the die 5 to have ducts 6, 7 for quickly discharging from the device any masses of air trapped between the punch 4 and the sheet F, on the one hand, or between the sheet F and the die 5, on the other hand, particularly when - as occurs in industrial processes - the pressing is to be carried out particularly quickly (with pressing times of less than one second).

At this point, the two half-egg-shaped wrapper pressings produced from the sheet F as shown in Figure 10 can be used to cover a chocolate egg U.

For this purpose, a first half-egg-shaped pressing F can be placed in a holding die 8 (which may in fact correspond to the die 5 used for the forming) in order to receive the egg U (which is formed according to widely known criteria in a moulding line, not shown) so that only the upper half of the egg U is left projecting from the die 8.

Another pressing such as that shown in Figure 10 can then be positioned thereon, so that the egg U is completely surrounded by sheet wrapping material.

At this point, it is necessary to close the formed wrapper and this can be achieved by joining the two half-egg-shaped wrapper pressings F together along their mutually facing portions around the periphery of

the egg U enclosed between them.

This can be achieved, at least in principle, by various techniques, such as mechanical joining by folding, gluing, ultrasonic welding, heat-sealing of the material constituting the wrapper pressings F, etc., possibly with the simultaneous cutting of the sheets F which are joined together around the periphery of the egg U.

In this connection, the need to satisfy a set of concomitant requirements should, however, be noted.

In the first place, the two aluminium wrapper pressings F must be joined without damaging the egg U, even locally. This risk may arise if the two sheet wrapper pressings F are joined together by heat-sealing the material of which they are made.

On the other hand, it is desirable for the sheet pressings F to be cut as close as possible to the product U in order to prevent the rim or "Saturn's ring" 11 which is formed around the egg U as a result of the cutting of the aluminium pressing from projecting too far, which would adversely affect its appearance even if the rim or ring 11 were then to be folded against the product U according to a current solution.

In this connection, the solution (which has already been mentioned for other reasons) of using a sheet material F which has a layer of heat-sealable lacquer or resin, for example polyethylene lacquer, on at least one of its faces (and, in particular, on the face which is intended to face the product U) has been found

particularly advantageous.

As has been seen, the presence of the layer of lacquer is beneficial for effecting the pleating operation. Moreover, the lacquer is wholly compatible with use for wrapping food products. Furthermore, the lacquer enables the two wrapper pressings F to be welded together easily by the lowering of a so-called heating muffle 9 near the region of the joint between the two pressings F around the periphery of the product U. In practice, the muffle 9 is constituted by an annular heated body defining an aperture, the shape of which closely imitates the outline of the egg U between the two pressings F of sheet material. Once it bears on the lips of the two pressings which are in contact with each other, as shown schematically in Figure 6, the muffle 9, which is brought to a temperature of the order of 80°, can melt the lacquer or resin locally so as to weld and securely join the two pressings F of sheet material together within a period of about 1 second. This causes no damage to the egg U (both because of the relatively low temperature and because of the short time of application).

The joint formed between the two pressings F of sheet material by the local melting of a lacquer or resin which covers their mutually facing surfaces is also beneficial for ensuring that the wrapper is completely sealed, even if there are slight folds or wrinkles along the mouth portions of the two pressings which are joined together.

The welding together of the two pressings F of sheet material, to which Figure 6 relates, is followed by the cutting of the wrapper around the periphery of the egg

U. This can be achieved with the use, for example, of a hollow punch 10 with a cutting edge 10a, the profile of which corresponds approximately to the outline of the product U in the region in which the two pressings F of sheet material are joined. In general, the cutting edge 10a follows the outline of the product U with a certain clearance so that its cutting action forms the rim or outer ring 11 constituted by the joined portions of the sheet material F when the tool 10 is removed (also removing the flat outer peripheral portions of the two pressings F of sheet material). This ring or rim forms a sort of flange 1 or 2 mm wide which projects from the finally wrapped product U. The ring or rim 11 can be folded against the outer surface of the wrapper by a subsequent folding operation.

In other applications, however, the ring or rim 11 may be left unchanged since its presence does not adversely affect the appearance of the final product.

Continuing with a more detailed examination of the structure of the pleating device 1, 2, (see in particular Figures 11 and 12), it can be seen that at least one and, preferably, both of the punch 1 and the die 2 have restraining formations 12, 13 in the generally flat regions surrounding the actual male and female die portions (which have the characteristics described in greater detail below), the restraining formations 12, 13 being constituted, for example, by portions 12 of foamed strip stuck to the flat surface of the male die 1 and an almost complete covering 13 on the flat face of the female die (the matrix) 2, also formed, for example, by an adhesive foamed strip.

Naturally, the relative positions of the portions 12 and of the covering 13 could be reversed with the portions 12 on the female die 2 and the substantially continuous covering 13 on the flat face of the male die 1.

As stated, the restraining elements 12 are formed, for example, by foamed strips each having an adhesive surface so that it can be applied firmly to the flat face of the respective die element 1 or 2, leaving free a generally smooth surface (that is, the surface facing the complementary die) which has a certain ability to yield resiliently.

The formations 12 and 13 are intended to grip the sheet F when it is interposed between the die portions 1 and 2 for the pleating operation.

The formations 12 and 13 actually grip the sheet F in a generally yielding or gentle manner, in the sense that they do not completely oppose the gradual movement of the sheet F towards the centre of the pleating device.

It can be seen in the lower portion of Figure 11, which relates to the matrix or female die 2, that the shaped portion of the die 2 has a set of ribs or grooves 3 which are oriented along its meridians for forming the pleats. By way of example, with reference to the formation of a wrapper for wrapping a chocolate egg having the size of a normal hen's egg, the matrix 3 may have a set of five grooves with generally triangular or V-shaped cross-sections, including a central groove, two intermediate side grooves and two outer side grooves. Naturally, different solutions may be used, according to the dimensions and the general shape of the product

to be covered. The same configuration of shaped portions is naturally used in a complementary manner, that is, in the form of ribs, on the male die or actual punch 1, which is shown in greater detail in the upper portion of Figure 11 and, in section, in Figure 12.

In the embodiment illustrated, the male die 1 thus also has five ribs with triangular or V-shaped cross-sections.

More precisely, it has a central rib 14, two intermediate side ribs 15 and two outer side ribs 16 for cooperating respectively (with the interposition of the sheet F to be pleated) with the central groove, the intermediate side grooves and the outer side grooves of the female die 2.

As already stated in the introduction to the present detailed description, whereas the female die or matrix 2 is generally flat (this term meaning it has a discontinuous profile extending substantially in alignment with the flat portion of the die 2), the male die 1, however, has a profile which - in the rest condition (that is, before it engages the die 2) - is not flat, in the sense that the central rib 14 projects beyond the intermediate side ribs 15 which in turn project beyond the outer side ribs 16. Naturally the term "project beyond" is intended to define a situation in which the respective rib projects or extends further from the die 1 than the adjacent outer ribs.

This can be achieved, as shown schematically in Figure 12, if the outer side ribs 16 are formed as parts which are integral with or fixed to the structure of the die 1 but the intermediate side ribs 15 and the central rib

14 are formed as blocks or punches which can slide relative to the body of the die 1.

Specifically, the inner boundaries of the outer side ribs 16 of the punch 1 define a generally oval or lenticular cavity 17 in which the intermediate side ribs 15 (which are thus generally C-shaped) can slide. The intermediate ribs 15 in turn define a further lenticular cavity in which the central rib 14, which in turn is generally keel or fin-shaped, can slide.

Respective screws, indicated 18 and 19, extend through holes in the end wall of the punch 1 (that is, through the face of the punch 1 which faces away from the mouth of the cavity 17). The screws 18 and 19 extend respectively into the central rib 14 and into each intermediate side rib 15 so as to regulate the sliding of the ribs into the cavity 17 against the reaction force exerted by respective springs 18a, 19a which are fitted around the shanks of the screws 18 and 19 within the cavity 17. Each spring acts between the end wall of the cavity 17 and the rib (the central rib 14 or an intermediate side rib 15) through which the corresponding screw 18 or 19 extends, urging the respective rib 14 or 15 outwardly of the die 1.

The spring 18a associated with the central rib 14 usually has a lower elastic constant than the spring 19a associated with the intermediate side ribs 15.

Thus, the arrangement is such that, starting from the rest position shown in continuous outline in Figure 12, the rib 14, and subsequently the ribs 15, can be made to enter the cavity 17 gradually. This takes place with a movement which, for the central rib 14, is

represented by an intermediate position shown in chain line and an end position shown in broken outline, the intermediate side ribs 15 travelling from the rest position indicated in continuous outline towards the end position shown in broken outline.

It will be appreciated that, when the ribs 14 and 15 are in their end positions, the punch 1 also assumes a generally flat configuration complementary to that of the die 2.

As stated, the sheet F is pleated by interposing the generally flat sheet F between the punch 1 and the die 2.

At the start of the pleating operation (with the punch 1 and the die 2 separated), the punch 1 is thus in the rest condition shown in continuous outline in Figure 12. As a result of the gradual movement of the punch 1 towards the die 2, the sheet F will then be engaged first by the central rib 14 which will engage the corresponding central groove of the die 2, thus forming a first central pleat in the sheet F. As the coupling movement of the two die elements 1 and 2 continues, the central rib 14 will start to be retracted into the punch 1, so that the intermediate side ribs 15 start to engage the corresponding intermediate side grooves in the die 2, thus forming two further pleats in the sheet F which is being pleated.

Finally, as the coupling movement of the punch 1 continues further towards the die 2, the ribs 15 will start to move towards the end wall of the cavity 17 (like the central ribs 14, which continue to be retracted into the punch 1) so that the outer side ribs

16 come into engagement with the corresponding grooves in the die 2, thus forming the outermost pleats in the sheet F.

This sequence of steps is shown schematically in Figures 13 to 15 which show that the pleating of the sheet F is not achieved by a single blow but, on the contrary, takes place gradually by the formation first of the central pleat, then of two side pleats on opposite sides thereof and, finally, of two further, outer pleats.

The sheet F is thus formed by a gradual movement during which the sheet F which is being pleated is drawn gradually towards the centre of the pleating device. This takes place under the yielding restraining action of the strips 12 and 13.

As stated, the presence of a lacquer or resin which has a certain lubricating effect (for example, a polyethylene resin or lacquer) on the opposite faces of the sheet F causes the pleating described to take place gradually without jerks, thus avoiding any problems of tearing of the sheet F.

Naturally, the principle of the invention remaining the same, the details of construction may be varied widely from those described and illustrated, without thereby departing from the scope of the present invention.

CLAIMS

1. A method of forming wrappers for articles (U), each having at least one rounded portion, from sheet material (F), in which the sheet material is formed (4, 5) into a dished shape before it is applied to the product (5), characterised in that it includes the step of pleating (1, 2) the portion of the sheet material which is intended to be formed into the dished shape.

2. A method according to Claim 1, characterised in that the pleating is formed (1, 2) along meridians of the dished portion.

3. A method according to Claim 1 or Claim 2, characterised in that the pleating is formed substantially symmetrically.

4. A method according to any one of the preceding claims, characterised in that the sheet material (F) is kept generally flat whilst the pleating is formed (1, 2).

5. A method according to any one of Claims 1 to 4, characterised in that a simultaneous limited movement of the sheet material (F) towards the centre of the region which is being pleated is promoted (14, 15, 16) whilst the pleating is formed.

6. A method according to Claim 1 or Claim 5, characterised in that the pleating is formed gradually and progessively (Figures 13 to 15).

7. A method according to Claim 5 and Claim 6, characterised in that the pleating is formed progressively starting from the central region of the

sheet (F) which is being pleated.

8. A method according to any one of Claims 1 to 7, characterised in that the pleating is formed by placing the sheet material (F) between two complementary die elements (1, 2).

9. A method according to any one of the preceding claims, characterised in that, during the pleating operation (1, 2), the sheet material (F) is subjected to a restraining action which is intended to oppose its retraction towards the centre of the region which is being pleated.

10. A method according to any one of the preceding claims, characterised in that at least one face of the sheet material (F) has a coating which can perform a certain self-lubricating function.

11. A method according to Claim 10, characterised in that the coating is on both faces of the sheet material (F).

12. A method according to Claim 10 or Claim 11, characterised in that the coating is constituted by a lacquer.

13. A method according to Claim 12, characterised in that the lacquer is a polyethylene-based lacquer.

14. A method according to any one of the preceding claims, characterised in that the sheet material (F) is a metal.

15. A method according to Claim 14, characterised in

that the material is aluminium.

16. A method according to any one of Claims 1, 14 and 15, characterised in that the sheet material (F) is less than one millimetre thick.

17. A method according to Claim 16, characterised in that the sheet material (F) is of the order of tens of microns thick.

18. A method according to Claim 17, characterised in that the sheet material (F) is about ten microns thick.

19. A method according to any one of the preceding claims, characterised in that, after the pleating, the sheet material (F) is formed into a generally dished shape by being positioned between a punch and a die (4, 5).

20. A method according to Claim 19, characterised in that at least one of the punch and the die (4, 5) has vent holes (6, 7) for preventing the formation of aeriform masses trapped behind the sheet material (F).

21. A method according to any one of the preceding claims, characterised in that the dished portion of the sheet material is intended to be joined to at least one complementary wrapper portion along at least one closed line which surrounds the product in order to wrap the product (U) completely, and in that the join is formed along the closed line by a technique selected from the group constituted by: mechanical joining, welding of the material constituting the wrapping sheet (F), ultrasonic welding of the material constituting the wrapper, and gluing by means of an applied material.

22. A method according to Claim 21, characterised in that the joint is formed by gluing, by means of the heat-sealing of an applied material.

23. A method according to Claim 10 and Claim 22, characterised in that the applied material is constituted by the self-lubricating coating on the face of the sheet material (F) which faces the line of the joint.

24. A method according to Claim 21 or Claim 22, characterised in that the wrapper is subsequently cut (10a) along the closed line.

25. A method according to Claim 24, characterised in that the cutting action is effected so as to form a rim or ring (11) which projects from the wrapper along the line of the joint.

26. A method according to Claim 25, characterised in that the rim or ring (11) is folded against the wrapper.

27. A device for pleating the sheet material (F) in the method according to any one of Claims 1 to 26, characterised in that it includes:

- a male die element (1) which has ribs (14, 15, 16) for defining the folds or pleats, and

- a female die element (2) which has grooves (3) complementary to the ribs (14, 15, 16).

28. A device according to Claim 27, characterised in that the ribs (14, 15, 16) and the grooves (3) are

within a pleating area which corresponds to a development of the dished portion in a plane.

29. A device according to Claim 28, characterised in that the ribs (14, 15, 16) and the grooves (3) are oriented along meridians of the pleating area.

30. A device according to Claim 28 or Claim 29, characterised in that the ribs (14, 15, 16) and the grooves (3) are arranged in a substantially symmetrical configuration.

31. A device according to any one of Claims 27 to 30, characterised in that the ribs (14, 15, 16) and the grooves (3) have generally triangular or V-shaped cross sections.

32. A device according to any one of Claims 27 to 31, characterised in that, of the set of ribs (14, 15, 16) and the set of grooves (3), one set (3) is in a generally fixed position on its respective die element (2) and the other set (14, 15, 16) is mounted on its respective die element (1) so that it can be retracted generally during the mating of the die elements (1, 2) as the pleating is effected so that the pleating is carried out in distinct portions of the sheet material (F) sequentially.

33. A device according to Claim 32, characterised in that the ribs (14, 15, 16) are mounted on the male die portion (1) for sliding generally in a respective cavity (17) so that the ribs (14, 15, 16) project at least partially from the male die element (1) in the rest condition, and can be retracted gradually into the cavity (17) during the coupling of the male die element

(1) with the female die element (2).

34. A device according to Claim 32 or Claim 33, characterised in that it has resilient means (18a, 19a) for opposing the retracting movement.

35. A device according to Claim 34, characterised in that the elastic constants of the resilient means (18a, 18b) associated with the ribs are different and are preferably greater for the ribs situated outwardly of the pleating area.

36. A device according to any one of Claims 27 to 35, characterised in that at least one of the male die element (1) and the female die element (2) has restraining means (12, 13) in the region surrounding the pleating area for exerting a certain restraining action on the sheet (F) which is being pleated by opposing its retraction towards the centre of the pleating area.

37. A device according to Claim 36, characterised in that the restraining means (12, 13) are on both the die elements (1, 2).

38. A device according to Claim 36 or Claim 37, characterised in that the restraining means (12, 13) can yeld resiliently.

39. A device according to Claims 36 to 38, characterised in that the restraining means (12, 13) are constituted by strips of foamed material.

40. A device according to any one of Claims 36 to 39, characterised in that the restraining means are in the

form of a substantially continuous covering (13) on one (2) of the die elements and in the form of discontinuous formations (12) on the other (1) die portion.

FIG. 1

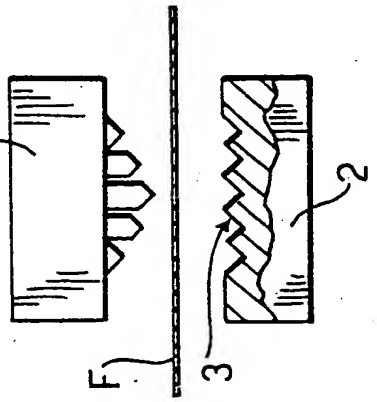


FIG. 2

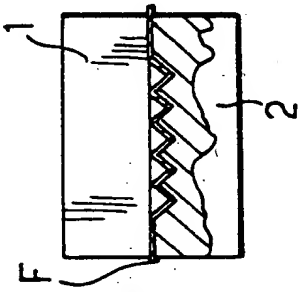


FIG. 3

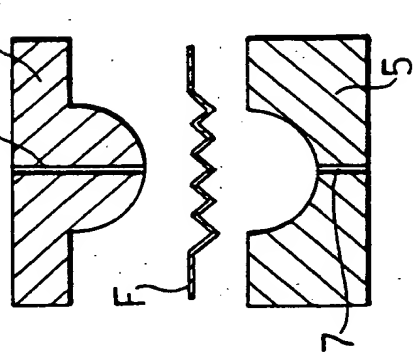


FIG. 4

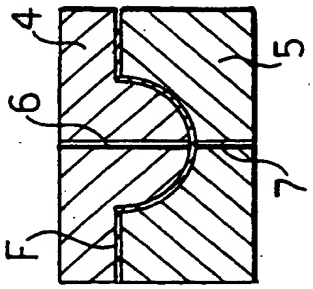


FIG. 5

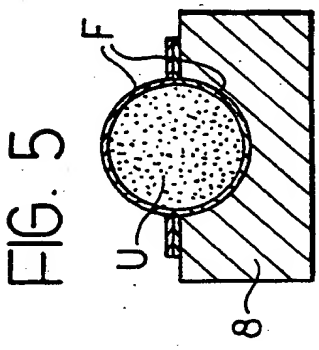


FIG. 6

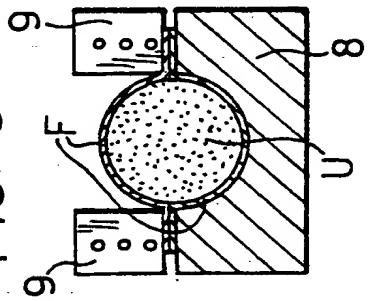


FIG. 7

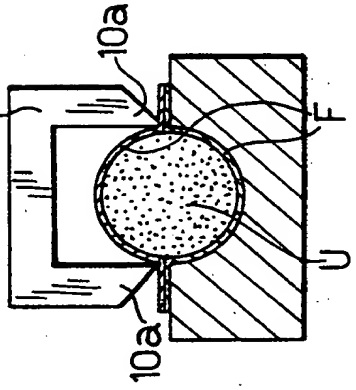


FIG 8

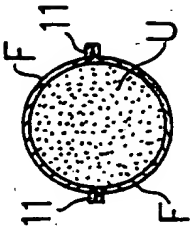


FIG. 9

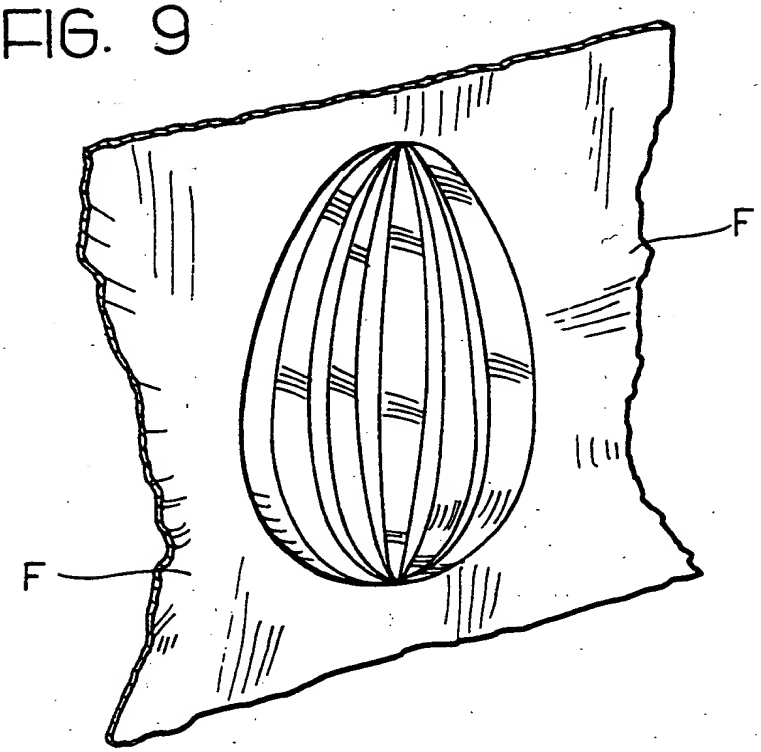


FIG. 10

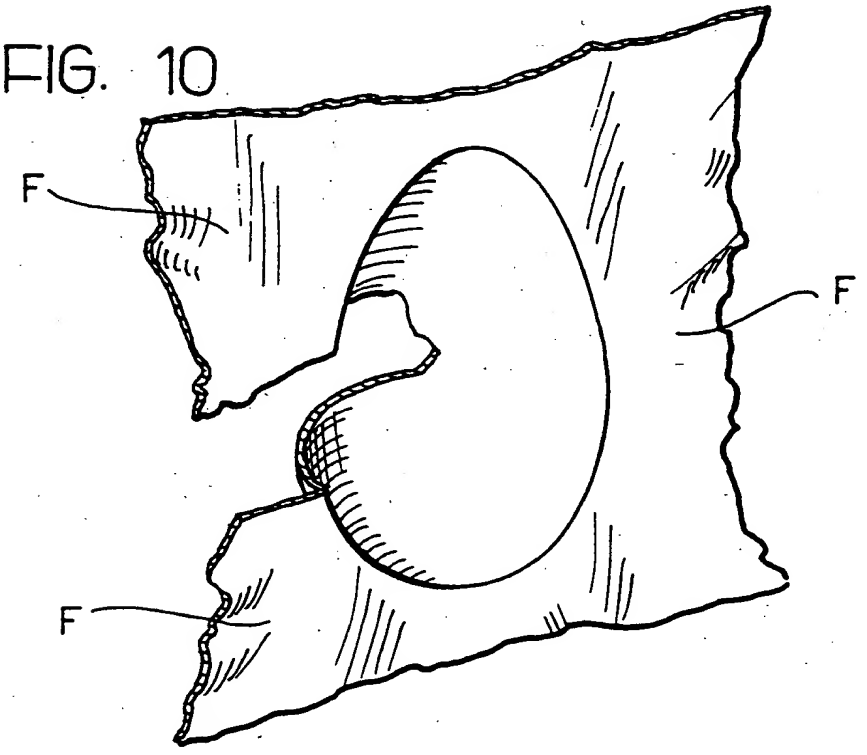


FIG. 11

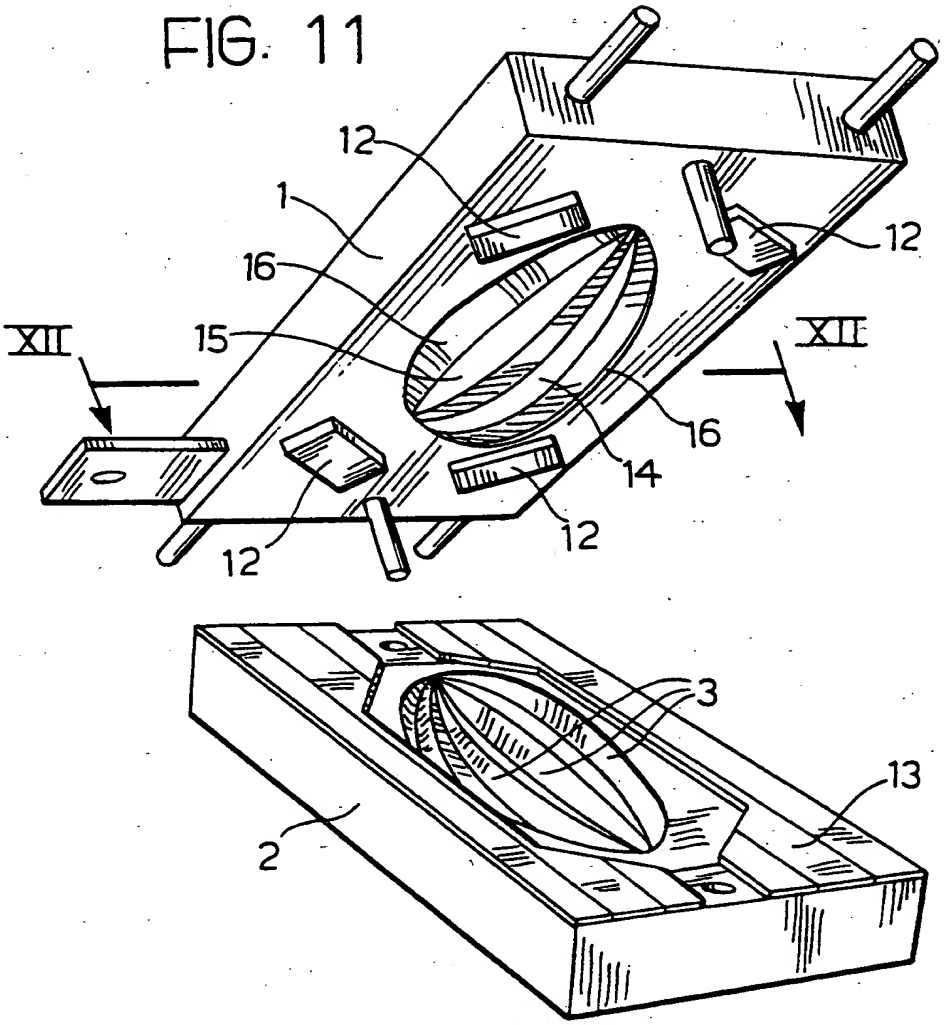

12
1
16
15
XII
XII
12
16
14
12
12
3
13
2

FIG. 12

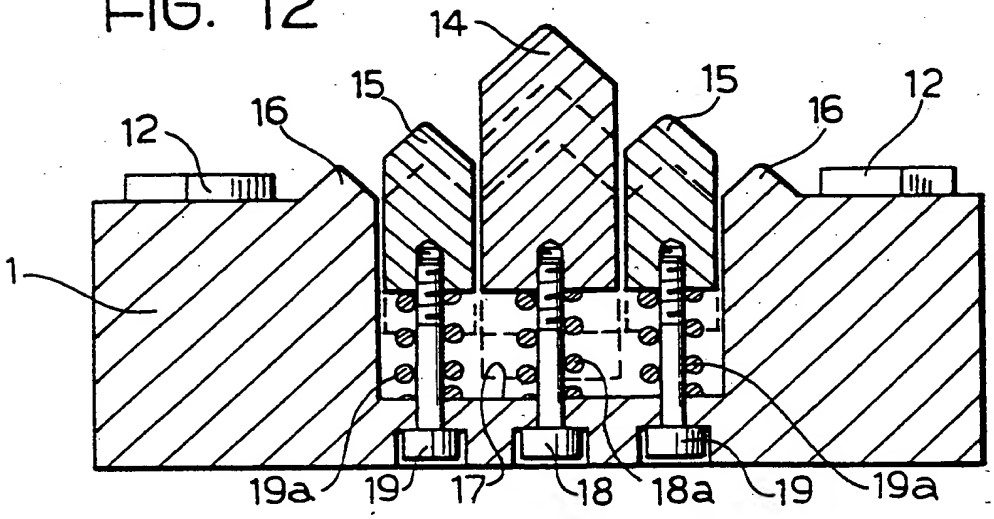

14
15
15
16
16
12
12
1
19a
19
17
18
18a
19
19a

FIG. 13

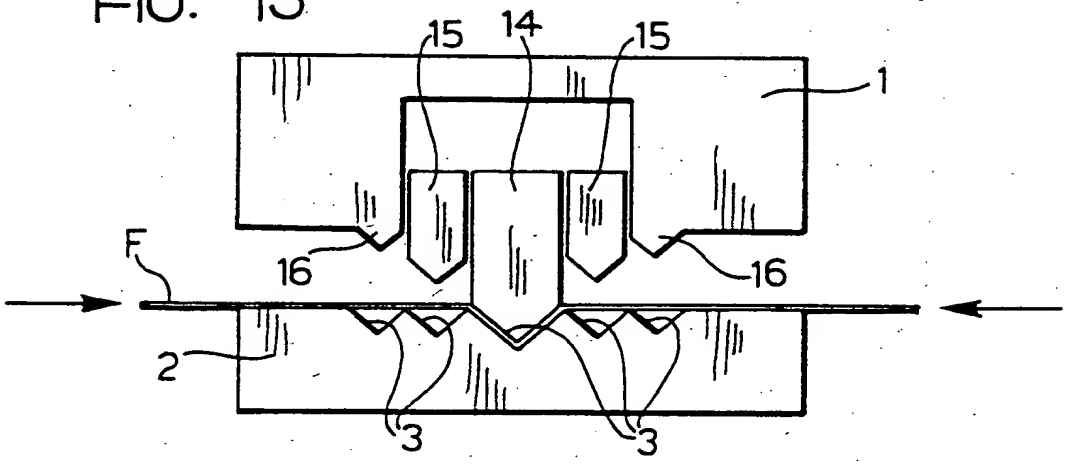


FIG. 14

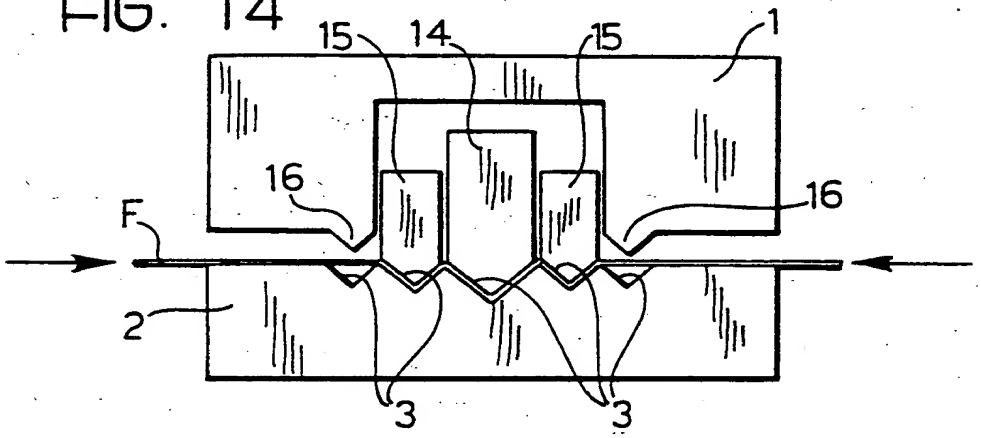
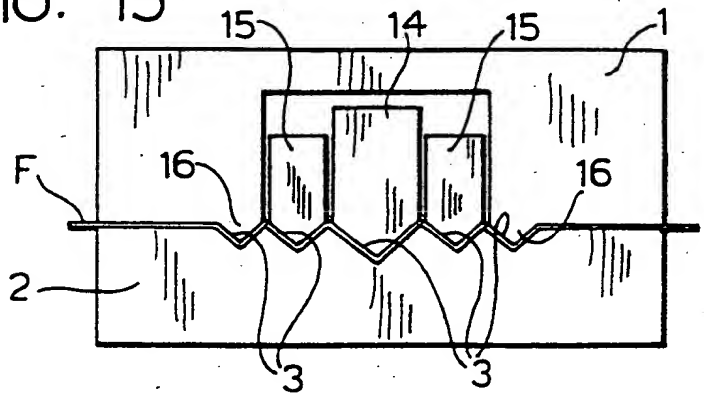


FIG. 15



I RNATIONAL SEARCH REPORT

International Application No PCT/EP 92/01438

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B65B11/50; B31F1/24

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B31F ; B29C ; B65B ; B21D B31B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	US,A,4 246 223 (PATTERSON) 20 January 1981 see the whole document ---	1-4, 8-16,19, 27-31, 36-38
X	US,A,3 748 889 (MILLER AT EL) 31 July 1973 see column 3, line 44 - line 55; figures 1-4 ---	27-34
A	US,A,3 144 974 (EICHNER ET AL) 18 August 1964 see column 2, line 4 - line 20; claims; figures 12,14 ---	1,14-19, 27
A	DE,C,598 113 (WANDER A. G.) 7 June 1934 cited in the application -----	1,14-15, 24-25

° Special categories of cited documents :[10]

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
13 OCTOBER 1992	02. 11. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	PIPPING L.E.

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. EP 9201438 SA 61907

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 13/10/92
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-4246223	20-01-81	None	
US-A-3748889	31-07-73	BE-A- 792036	29-05-73
		DE-A- 2255850	07-06-73
		GB-A- 1398027	18-06-75
		JP-C- 979498	14-12-79
		JP-A- 48064145	05-09-73
		JP-B- 54011824	17-05-79
US-A-3144974		None	
DE-C-598113		None	